WHAT IS CLAIMED IS:

1. An optical antioxidant sensing process for measuring the free radical scavenging efficiency of a nutritional formulation when encountering reactive oxygen radical species in a medium comprising the steps of:

introducing an organic dye reagent that reacts with oxygen radicals to said medium to chemically tag said oxygen radicals in said medium;

detecting and measuring the population of said tagged oxygen radicals using an optical fiber sensor;

introducing a nutritional formulation with antioxidant properties to said medium;

detecting and measuring the relative population of said tagged oxygen radicals in said medium using said optical fiber sensor;

calculating the free radical scavenging efficiency of said nutritional formulation using said oxygen radical population measurements; and

assaying the free radical scavenging effectiveness of the nutritional formulation.

2. The optical antioxidant sensing process of claim 1 wherein said organic dye reagent has a chemical composition that diffuses through a cell membrane.

3. The optical antioxidant sensing process of claim 1 where said organic dye reagent is 2-7 Dichlorofluorescin (H_2DCFDA);

4. An optical antioxidant sensing process for measuring the free radical scavenging efficiency of a nutritional formulation when encountering reactive oxygen radical species in a medium comprising the steps of:

introducing an organic dye reagent that reacts with oxygen radicals to said medium to chemically tag said oxygen radicals in said medium;

introducing an oxygen catalyst promoter to said medium to increase oxidative activity;

detecting and measuring the population of said tagged oxygen radicals using an optical fiber sensor;

introducing a nutritional formulation with antioxidant properties to said medium;

detecting and measuring the relative population of said tagged oxygen radicals in said medium using said optical fiber sensor;

calculating the free radical scavenging efficiency of said nutritional formulation using said oxygen radical population measurements; and

assaying the free radical scavenging effectiveness of the nutritional formulation.

5. The optical antioxidant sensing process of claim 4 wherein said organic dye reagent has a chemical composition that diffuses through a cell membrane.

6. The optical antioxidant sensing process of claim 4 where said organic dye reagent is 2-7 Dichlorofluorescin (H_2DCFDA);

7. The optical antioxidant sensing process of claim 4 wherein said oxygen catalyst promoter is from the group consisting of H_2O_2, peroxidase, transition metals, hydroxides and superoxides.

8. The optical antioxidant sensing process of claim 4 wherein said oxygen catalyst promoter is horseradish peroxidase.

9. An optical antioxidant sensing process to measure the free radical scavenging efficiency of nutritional formulations comprising:

forming a control group including a medium that contains tagged fluorescent oxygen radicals;

incubating a first portion of said control group with a first sample of a nutritional formulation having antioxidant properties;

incubating a second portion of said control group with a second sample of said nutritional formulation having antioxidant properties in isolated form;

measuring the free radical scavenging activity of said first sample in said first portion of said control group using an optical fiber sensor;

measuring the free radical scavenging activity of said second sample in said second portion of said control group using said optical fiber sensor; and

assaying the antioxidant capacity of said first and said second samples.

10. The optical antioxidant sensing process of claim 9 wherein said first sample comprises a food-based source of a key phytonutrient with antioxidant capabilities;

11. The optical antioxidant sensing process of claim 9 wherein said first sample comprises a vitamin with antioxidant capabilities such as wheat germ oil;

12. The optical antioxidant sensing process of claim 9 wherein said second sample comprises a key phytonutrient with antioxidant capabilities in isolated form;

13. The optical antioxidant sensing process of claim 9 wherein said second sample comprises a vitamin with antioxidant capabilities in isolated form;

14. The optical antioxidant sensing process of claim 9 wherein said second sample comprises wheat germ oil.

15. The optical antioxidant sensing process of claim 9 wherein said second antioxidant sample is an isolated form of vitamin E proven to have antioxidant activity. .

16. The optical antioxidant sensing process of claim 9 wherein said second antioxidant sample is Trolox.

17. A process for measuring antioxidant activity in an in-vitro model mimicking the gastrointestinal tract comprising the steps of:

introducing a functional food-based antioxidant sample to a first vessel containing ingredients that mimic the environment in a stomach segment of said gastrointestinal tract;

pumping the resultant solution into a second vessel containing ingredients that mimic the environment in a small intestine segment of said gastrointestinal tract;

introducing a pancreatic fluid solution to said second vessel to further mimic the environment of said small intestine segment;

introducing a bile salt solution to said second vessel to further mimic the environment in said small intestine segment;

pumping the resultant solution into a third vessel containing ingredients that mimic the environment in a large intestine segment of said gastrointestinal tract; and

assaying solutions from said vessels using the optical antioxidant sampling process of the invention to determine the solution's relative intracellular effects on free radicals in said gastrointestinal tract.